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ABSTRACT

A study examined the construct and predictive validity of phonemic awareness to determine the strength of the relationship between phonemic segmentation and auditory abstraction and to determine which of the two measures provided the best prediction of word recognition ability. Data were gathered from 65 first-grade children from 2 public elementary schools from lower to middle socioeconomic levels in 2 southern California school districts. Three tests were individually administered to each child: the Yopp-Singer Test of Phonemic Segmentation; the Beach-Singer Test of Auditory Abstraction; and the Gates-McKillop-Horowitz Reading Diagnostic Tests, Words: Untimed Subtest. Results revealed statistically significant correlations between word recognition and auditory abstraction and between word recognition and phonemic segmentation. The findings support the predictive validity of the construct of phonemic awareness for word recognition and decoding. Findings also indicate that phonemic segmentation and auditory abstraction are important abilities for a child to develop to be successful in word recognition. Further research into causal explanations of whether phonemic awareness develops prior to or as a result of formal reading instruction appears to be called for. (One figure and four tables of data are included; 14 references are attached.) (KEH)

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THE INTERRELATIONSHIP OF PHONEMIC SEGMENTATION, AUDITORY ABSTRACTION, AND WORD RECOGNITION

by

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Paper presented at the annual meeting of the International Reading Association, Atlanta, Georgia, May, 1990

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THE INTERRELATIONSHIP OF PHONEMIC SEGMENTATION, AUDITORY ABSTRACTION, AND WORD RECOGNITION

Phonemic awareness, the ability to manipulate the sounds of language, has been shown to be important to success in learning to read (Juel, Griffith, & Gough, 1986; Lundberg, Frost, & Petersen, 1988; Mann & Liberman, 1984; Torneus, 1984; Treiman, 1985; Tunmer & Nesdale, 1985; Williams, 1984). The construct of phonemic awareness, however, has been tested with many different types of tasks. Liberman, Shankweiler, Fischer, and Carter (1974) tested young children's phonemic awareness by their ability to segment syllables and phonemes. Fox and Routh (1984) considered phonemic awareness as both blending and segmenting syllables and phonemes. Maclean, Bryant, and Bradley (1987) added rhyme, nursery rhymes, and alliteration in their testing of phonemic awareness in early childhood. In their screening tests, Vellutino and Scanlon (1987) utilized initial consonant substitution as a method of determining phonemic awareness. Mann, Tobin, and Wilson (1987) analyzed the invented spelling of children as a measure of their ability to manipulate the sounds in words. All of these studies pointed to the importance of phonemic awareness in learning to read, but they used different operationalized definitions of the construct.

Yopp (1988) attempted to establish the validity of phonemic awareness in her study of the different tasks used to

operationalize it. She gave 100 kindergarten children ten different tests encompassing the different operationalized definitions of phonemic awareness. Using a factor analysis and a stepwise multiple regression analysis, Yopp determined that two factors underlie phonemic awareness and that both were predictors of success in reading words. The first factor, which she named Simple Phonemic Awareness, included those tasks involving simply segmenting or blending phonemes. The second factor, named Compound Phonemic Awareness, included those tasks which involved not only segmenting and blending phonemes but also performing some operation on those sounds which had been held in memory. The study has two limitations. First, the second factor Yopp identified was only marginal on two tests for keeping the factor, Cattell's scree test and eigenvalues greater than one. Second, the criterion variable that Yopp used in the stepwise regression analysis was not the child's ability to read real words, but rather the ability to learn and read pseudowords, which adds evidence only of the prediction of phonemic awareness ability to success in the application of decoding skills.

Auditory abstraction was conceptualized and defined by Harry Singer (1987, personal communication) as the ability to abstract a common sound from two or more words. It involves segmenting two or more words, holding all of the sounds in memory, and abstracting the common sound. If the two factor structure hypothesized by Yopp (1988) is valid, auditory abstraction would be classified as Compound Phonemic Awareness. In addition, it

would be at least moderately related to phonemic segmentation ability since both tasks would be tests of a child's phonemic awareness. Auditory abstraction would be important to word recognition ability because a child must be able to abstract sounds from familiar words and put them into novel words in order to decode them.

The purpose of this study is to add further evidence to the construct and predictive validity of phonemic awareness. Specifically, the purpose is threefold: (1) to discover the strength of the relationship between phonemic segmentation and auditory abstraction; (2) to determine how many factors were involved; and (3) to ascertain which of the two measures of phonemic awareness, or if both measures, provided the best prediction of word recognition ability.

Method

Sample

The sample consisted of 65 first grade-children from two public elementary schools in two southern California school districts. No child was younger than six years old nor older than six years, ten months at the beginning of the study. The children were 45% white, 25% Black, 25% Hispanic, and 5% Asian. School A, attended by 36 of the children, was a school classified as a Chapter I school which drew from a population that was predominantly in the lower to lower-middle socioeconomic levels. School B, attended by 29 of the children, was a school that drew from predominantly lower-middle to middle socioeconomic

neighborhood.

Measures

Three tests were individually administered to each child by myself and 3 student teachers under my supervision.

1. The Yopp-Singer Test of Phonemic Segmentation (Yopp, 1988) was developed to measure a child's ability to segment words into their component sounds and articulate them in order. The 22 words used in this test were selected for both their familiarity and their features. Directions were as follows:

> We're going to play a word game. I'm going to say a word. You are going to break the word up and tell me the sounds in it in order. For example, if I say so, you will say s-o. Now you try it.

The word was then repeated for the child to segment. Three more examples were given. Feed back was given for each example and the child was asked to repeat the correct response. The test was then administered. Only those words correctly segmented were scored as correct. Incorrect responses were recorded as given by the child. The test took approximately 10 minutes to administer. Possible range of scores was 0 to 22.

2. The Beach-Singer Test of Auditory Abstraction was the measure developed for this study. Its purpose was to measure a child's ability to abstract the common sound out of three words. The word list was based on familiarity. Correct responses included three diphthongs, three digraphs, four long vowels, five short vowels, and fifteen consonants. Directions for the test

were as follows:

> Today we're going to play a listening game. I'm going to say three words. You listen carefully to the words that I say. Listen for the sound that is the same in all of the word. You tell me that sound. Let's practice together before we play. I say the words MAN COME ME. I hear the /m/ sound in COME, the /m/ sound in MAN, and the /m/ sound in ME. The sound that is the same in MAN, COME, ME is /m/. Now you try it.

The same three words were given to the child and feedback given. Three more examples were practiced before the actual test began. Feedback was given for each example and the child repeated each incorrect response correctly. During the actual testing session, correct responses were scored with a check and incorrect responses were recorded verbatim on the test sheet. If six incorrect responses in a row were made, the test was stopped. Each test took approximately ten minutes to administer.

3. The first 40 words from the Gates-McKillop-Horowitz Reading Diagnostic Tests, Words: Untimed Subtest (1981) were used to assess each child's word recognition ability. Each word was written on a card and presented randomly to each child in the following manner:

> Today I'd like you to read some words for me. Some will be easy and some will be hard, so do the best that you can. I'll give you the card that you can read and I'll keep the ones that you can't read.

The cards were presented one at a time with no time limit. The list took approximately 10 minutes to administer.

The auditory abstraction and phonemic segmentation tests were administered between the last week of October and the first week of December of the first grade year. The test of word recognition was given during the last two weeks of February of that same school year. The number of children changed from the administration of the first two measures to administration of the last measure due to illness or moving from the school's attendance area. Thus, only 57 of the original 65 children took the word recognition test.

Results

Table 1 summarizes the means, standard deviations, total number of items, and internal consistency reliability coefficients for the two phonemic awareness measures. Both of the experimental measures had high internal consistency, alpha = .93 for the phonemic segmentation test and alpha = .91 for the auditory abstraction test. Table 2 summarizes the correlations between the three measures. All correlations were statistically significant ($p<.0001$). Word recognition and auditory abstraction were the most highly related ($r=.61$), followed by the relationship between word recognition and phonemic segmentation ($r=.57$). Auditory abstraction and phonemic segmentation were correlated .49.

TABLE 1

DESCRIPTIVE STATISTICS

Test	N	Items	Mean (S.D.)	Alpha
Phonemic Segmentation	65	22	7.42 (6.44)	.94
Auditory Abstraction	65	30	10.06 (6.85)	.91
Word Recognition	57	40	15.37 (9.87)	N/A

TABLE 2

CORRELATION MATRIX

Test	Phonemic Segmentation	Auditory Abstraction	Word Recognition
Phonemic Segmentation	1.00	.49	.57
Auditory Abstraction		1.00	.61
Word Recognition			1.00

Items in the phonemic segmentation and auditory abstraction tests were grouped together in clusters of items prior to factor analysis. The items of the phonemic segmentation test were grouped together by common patterns of vowels and consonants in the words. The items in the auditory abstraction test were grouped together by type of letter sound the child was asked to

abstract. (See Table 3.)

TABLE 3

DESCRIPTION OF PARCELS

Test	Parcel	Description
Auditory Abstraction	1	Diphthongs --/oo/, /ou/, /oi/
	2	Digraphs --/th/, /sh/, /ch/
	3	Long vowels --A, E, I, O
	4	Short vowels --A, E, I, O, U
	5	Consonants -- S,R,L,B,D,K,N,P,F,C,Z,V,T,J
Phonemic Segmentation	6	Words following a C-V pattern
	7	Words following a V-C pattern
	8	Words following a C-V-C pattern
	9	Words following either a C-V-C-e or C-long vowel combo-C
	10	Words beginning either with a blend or a digraph

A correlation matrix of the intercorrelations among the clusters of items as well as correlations of the clusters with total scores of the instruments showed moderate to high correlations of each cluster with the total score of the test it was a part of, as well as with the other clusters making up that test, and low to moderate correlations with the clusters and total score of the other instrument.

A factor analysis was then performed on the clusters of

items of both tests. The common factors methods, with squared multiple correlations for the communalities indicating common variance, was used to determine the final factors kept for rotation. Using the criteria of "eigenvalues greater than 1" and Cattell's scree plot, two factors were kept for oblique rotation. Oblique rotation was chosen because the factors were hypothesized to be related to each other. After rotation, the factors were correlated r=.47. Table 4 shows the rotated factor pattern. The clusters of items of the phonemic segmentation test loaded highly on Factor 1, while the clusters of items from the auditory abstraction test loaded highly on Factor 2.

INSERT FIGURE 1 ABOUT HERE

TABLE 4

ROTATED FACTOR PATTERN

Parcel	Factor 1	Factor 2
AA1	-.1172	.5449
AA2	-.0421	.6998
AA3	.2203	.4476
AA4	.1202	.6014
AA5	.0448	.7512
PS6	.6278	.2071
PS7	.8853	-.1134
PS8	.8640	.0736
PS9	.8120	.0313
PS10	.8061	-.0837

The total scores of the two experimental tests were then placed in a multiple regression equation with word recognition as the dependent variable. Each placed separately into regression equations accounted for between 32 and 38% of the total variance. When both tests were entered into the equation, 46% of the variance in word recognition ability was accounted for by phonemic segmentation and auditory abstraction, and the slopes for both were statistically significant ($p<.004$).

Discussion

This study, then, supports a two-factor structure for the construct of phonemic awareness. Factor 1, Simple Phonemic Awareness, contained the items of the Yopp-Singer Test of Phonemic Segmentation which involves hearing a word, segmenting it into the phonemes that make it up, and responding with those sounds in the order they were heard in the words. Factor 2, Compound Phonemic Awareness, contained the items of the Beach-Singer Test of Auditory Abstraction. It requires that the child segment a given word, hold the sounds in memory, segment two more words and hold those sounds in memory, choose a common sound, and respond with that sound. That both of the factors and, consequently, both tests require a child to segment a word into its constituent phonemes explains the moderate correlation between the two tests as well as between the two factors.

The high relationship between each of the experimental instruments and the word recognition measure supports the predictive validity of the construct of phonemic awareness for

word recognition and decoding. The results of the multiple regression analysis indicate the both phonemic segmentation and auditory abstraction are important abilities for a child to develop in order to be successful in word recognition.

The major limitation of this study is that it does not add evidence to causal explanations of whether phonemic awareness develops prior to or as a result of formal reading instruction. It only provides evidence of the importance of phonemic awareness to achieving success in word recognition. Experimental research is needed to confirm causal directions. The study has several important implications for educational practice. First, it provides two reliable measures of both aspects of phonemic awareness which could be used by teachers to identify the level of phonemic awareness of children in late kindergarten/early first grade. This information could be used to determine those children needing instruction and practice in segmenting and abstracting the sounds in words. From these measures, informal tasks could also be developed for use in kindergarten to monitor the development of phonemic awareness occurring as a result of experiences with language. These informal tasks could also be used to help identify which language experiences are most beneficial in the development of necessary phonemic skills. Thirdly, this study provides reliable research instruments which could be used in experimental situations involving the testing of reading and writing curriculums in the primary grades.

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Figure 1
Scree Plot of Eigenvalues